Best Practice White Paper
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White Paper Objective:

The multiple project delivery methods that exist today each have their own advantages and disadvantages. Some procedures within the methods have also been proven to be effective when applied to most project formats, specifically transportation projects. In order to improve the overall capabilities of a transportation agency, it would be advantageous to seek out these effective procedures and gather them in purpose to refine the existing procedures of the said agency. Through our own methods we, The Center of Excellence in Project Management at the Department for Civil/Environmental Engineering at the University of Maryland, have done this very action. We have identified a multitude of best practices throughout the transportation construction industry and assembled them in a reviewable format in order to aid the Maryland State Highway Association (MDSHA). We conducted a thorough, comprehensive and objective literary review over many other state's departments of transportation (DOTs) best practices involving each project delivery methods in use. In the following white paper review, we plan on achieving a few different objectives. Our first objective is to describe in detail what exactly we mean by the term 'best practice' and other related terminology. Our second objective is to describe what we found to be best practices in other states and to determine how those other states have employed them. Our final objective is to determine how the MDSHA could employ these techniques into their own repertoire in order to improve their overall effectiveness and abilities.

What do we mean by Best Practice?

Our definition for best practices is that they are effective strategies, techniques and procedures that are employed by an operating entity of a project in order to most efficiently handle a particular task or process. Through our research, we have broken down these best practices into three related definitions based on their validity. The definitions for these best practices are grouped as: Validated Best Practices, Model Practices, & Recommended/Suggested Practices.

Validated Best Practices are those that have been used by state DOTs and have been proven to yield good results on a regular basis. An example of a best practice that we have determined to be validated would be that training is needed in order for an agency to switch over to a new project delivery method. The reason that this practice was determined to be validated is because almost all states using construction manager-at-risk (CMR) as a project delivery method employed the practice, multiple sources of literature agreed that the practice was effective in all cases, and its application consistently yielded solid results.

The second definition, 'Model practices', are those that have been identified to work effectively by certain states but have not been uniformly applied by every state using a particular project delivery method. An example of a model practice used in CMR is that there should be a heavy emphasis on community involvement. The reason this is a model practice is because there are only a few states who stressed this practice as being integral to the effective delivery of a CMR project.

The final definition that we grouped best practices into, recommended/suggested practices, is defined as those that are recommended by professionals based on their observation, but have no real-world example to justify the effectiveness of the practices. The research group has suggested these practices may be feasible but currently we don't have enough information to demonstrate their effectiveness or determine the efficiency of the practice. An example of a recommended/suggested practice is to minimize schedule driven design. This practice falls under the category because it has not adequately been applied to any state in particular but it has been recognized by some researchers as being a potential area of improvement for the CMR project delivery method.

What are the Best Practices?

After we established what a particular best practice was defined as, we further organized each practice into two main categories. Each of these main categories had their own subcategories in order to more accurately situate the practice for the MDSHA to internalize. We found that the two main categories that each practice fell into were either, Institutional/Political & Technical. From there, we broke down the Institutional/Political category into the subcategories of: Stakeholders and Public Engagement, Internal Affairs, & Program management. Additionally, we divided the Technical category into the sub categories of: Project Identification Procedures, Project Procurement/Development, Project Management, Project Design, Risk Management, Project Communications, & Construction Procedures.

We can start by defining the Institutional best practices as being practices that mainly apply to the overarching forces which lie outside of a specific ongoing project but instead in an area that influences the capabilities of an agency to efficiently perform any project.

Included in this category are Stakeholder and Public Engagement best practices. These are practices which specifically revolve around handling the people not directly involved in the construction of a project but still play an important role in the overall success of the project. An example of one of these types of practices that we discovered in our data collection was 'Placing a heavy example of Community involvement'. This model practice was used by Arizona and Missouri in a number of interesting ways. The city of Phoenix Arizona's DOT in particular created their own social media channels in order to broadcast information about the various projects they were currently involved in and how these projects were going to affect the public. Through this communication, they were able to answer comments and concerns from the population who would ultimately benefit from their finished work.

The second subcategory in Institutional best practices is that of 'Internal Affairs'. This subcategory specifically relates to processes that an agency employs in order to enhance the general effectiveness of the organization when carrying out any type of project or internal operation. An example of a model practice that falls under this category is 'Putting best people on the job and teaming with the best'. This practice was emphasized by the states of Florida and Utah. Specifically, the state of Utah mentioned that they feel comfortable with reducing the overall size of their staff if they have the right people working on the project at that time. By reducing the amount of staff, it also reduces the overall budget with which the agency has to manage. The final subcategory that composes the Institutional overall category is, Program Management. This subcategory category mostly handles the best practices that are associated with the process that an agency goes through when organizing and choosing the overall delivery

method for a certain type of project. An example of this is the recommended practice of 'Having a DB champion and a DB policy committee within the agency'. This is currently being looked into in a number of states but has yet to be fully deployed in action. The function of this practice would be for the person who is the champion to serve as the single point of information for the DB program and an advocate for the delivery method. The committee would discuss DB relevant issues that affect departmental policies and procedures. This process would help smooth the transition that an agency makes from a previous project delivery method, like design bid build (DBB), into an alternative delivery method like design build (DB).

The second main category known as, Technical best practices, can be defined as those practices which are essential to the process of a specific project taken on by an agency. Included within this main category is the subcategory of 'Project Identification Procedures' the process which determines if a project is eligible to use the specific delivery method. Another sub category within the Technical category is 'Project Procurement/Development'. This deals with the tasks associated with the contracting of a project & the activities which plan and create a scope of work. An example of a validated best practice from our studies that fit under this category was for the 'CMR to procure early work packages'. Both Utah's and Memphis Tennessee's DOTs used this practice in order to "mitigate cost risk by locking in the cost of the materials and services associated with those package" (Gransberg & Shane, 2010, p. 3). It was highly agreed upon by many experts and DOTs in the field that the earlier this action is executed, the greater potential for benefits to arise.

An additional subcategory Technical best practices are broken down into is 'Project Management'. This subcategory deals with the different and specific management practices utilized in any of the alternative project delivery methods. An example of a best practice that falls into this slot is 'The ultimate subcontractors who perform the work of the project should be selected by the CM/GC'. This model practice was utilized by a number of different states all of which determined this method to be much more effective than for the Agency to place significant intervention in this process. This practice was effective because among many things, it allowed the agency "to get real-time pricing information,[because] the CMR is able to communicate with the subcontractors it knows during preconstruction" (Gransberg & Shane, 2012, p. 68).

A third subcategory that composes the Technical main category is that of 'Project Design'. The best practices grouped in this category are related to the efforts and work done in association with the design phase of a project. A specific example of a best practice that fits this category was that the project team should, 'Correlate directly the design packages with the subcontractor bid packages'. This model practice was used by a number of states including Utah, Oregon and Texas, all of which praised its effectiveness. They mostly stated that this needs to happen in order to mitigate risk and fast-track the overall project. It can also greatly improve savings during the preconstruction process.

A fourth subcategory within the Technical main hub is the 'Risk Management' area. Best practices that are grouped in this subcategory mainly deal with the assessment and engagement of risk. An instance of a best practice that fit this category and that was used extensively by Utah's DOT was that of 'Develop a quality management plan'. "The Quality Management Plan (QMP) is the document detailing all quality program procedures adopted by design-builders" (Minchin et al., 2014, p.121) and Utah required the DB to use this in order to ensure design package quality.

A fifth subcategory included in the Technical main category is 'Project Communications' area. The best practices that were included in this subcategory revolved around how project

participants are interconnected and how they transfer ideas, documents, and commands between each other. A case in which a best practice fit this category was that of the 'Collaboration of CMR and Designer' should be ensured. The Memphis Tennessee DOT specifically focused on this model practice because they claimed that "Doing this makes preconstruction collaboration enforceable and gives the designer the opportunity to set appropriate prices for the activities that do not occur in a DBB design project" (Shane & Gransberg, 2010, p.57).

The final subcategory that composes the Technical main category is 'Project Construction'. Any best practice that made it into this subcategory dealt with the characteristics of construction in a given alternative project delivery method. One best practice that fits perfectly into this subcategory is that of 'Use monthly reports along with invoices to ensure construction cost control'. This best practice was thoroughly used by Florida's DOT in their Osceola County project and they claimed it to be one of their best practices to ensure that the construction cost was kept within budget. They described them as, "These gave detailed information on all costs to date and were compared to the schedule of values that had been approved for the project" (Minchin et al., 2014, p. 178) and they essentially worked by expediting the speed in which bids arrived, concerning the engineer's designs on the project.

It should also be noted that while there were a few examples given in the previous paragraphs about the various best practices that were discovered, there is even more details available on a further number of best practices that was collected. This information is located in the attached appendix and includes mostly information taken directly from literary sources that were observed during the review. The more complex best practices are laid out in full detail in their original source, if it remains desirable to further investigate the best practices.

How to use the Best Practices?

To be able to use or employ each best practice that was discovered in the research, we need to consider Maryland's current circumstances. These include such processes as legislation, MDSHA organization, past experience, and contractor characteristics in each district. The MDSHA should examine these circumstances and evaluate if they can accommodate the requirements for each best practice. The MDSHA should also list and evaluate the kinds of arrangements to be made in order to implement the best practice. It should also be noted that the MDSHA should take special care when implementing the recommended/suggested practices, as we have found no validated results. Each best practice has specific methods of implementation that should be learned by MDSHA officials in order to most appropriately employ the practice within the organization. If this is done properly, there are a range of immediate benefits that come from being able to employ these practices on future projects. Anywhere from decreasing the overall cost, to reducing the project's schedule, to improving the agency's public image can be achieved through the employment of these best practices. We hope that we can continue to assist the MDSHA with our final development of a guidebook that will break down each best practice in order for them to be most effectively understood within the administration.

Overall Category	Project Delivery Area:	Best Practice Name:	Short Description:	Example/ State:	Possible Implementation Process:	Source:	Application Area, DB or CMR?	Validated BP, model practice, or recommended/suggested practice?	Already included in DB Manual?
Technical	Procurement/Development	CMR to procure early work packages	"Allowing the CMR to procure early work packages [typically materials to be installed by subcontractors] is reported to mitigate cost risk by locking in the cost of the materials and services associated with those packages." (Gransberg & Shane, 2010, p. 3). Also Gransberg & Shane mentioned on page 12 that many other sources they analyzed agreed with that statement. "Although [they] vary per project, there are typically three to five GMPs based on early procurement items as well as early work items."(Minchin, 2014, p. 67). As stated by Utah DOT, "construction starts sooner in the design process due to early work packages."(Minchin et al., 2014, p. 199)	Utah DOT, Memphis, Tennessee	Either have something written into the CMR contract in order to ensure this or encourage the designer to collaborate more with the CMR. There is also further detail on page 12 of Gransberg & Shane 2010.	#9, #13	CMR	Model Practice	N/A
Institutional	Stakeholder/ Public Engagement	Have contractor deal with permitting agency.	"The Utah DOT case study interview indicated that permitting agencies are more willing to expedite their process if they are dealing with a contractor because they believe the chance of significant design changes has passed after a contractor has been selected (Alder 2007)." (Gransberg & Shane, 2010, p. 54) "One interesting aspect on this project was that the CMR found that it could get permits in about ¼ the time it took the agency because the permitting agencies perceived that the design would not change from that displayed in the permit application if a construction contractor was the one pulling the permit."(Schierholz, 2012, p. 152)	Utah, Oregon	Assign this task to directly to the Contractor's contract.	#9; #16	CMR	Model Practice	N/A
Institutional	Program Management	Use the Correct project delivery process	"An owner should conduct a thoughtful, proactive and objective assessment of the unique characteristics of its program/project and its organization before making the decision to use design-build." (Loulakis, M., & Hoag, 2013, p. 3)	N/A	Refer to pages 9 to 12 in the report by Minchin et al. 2014.	#9, #10	DB	Recommended/Suggested practice	No
Technical	Procurement/Development	Early Selection of the CMR	"Selecting the CMR at a point in time where it can influence fundamental design decisions before they are made not only saves design costs but also maximizes the opportunity for the CMR to add value to the project. This can be before the selection of the designer. If an agency wants to evaluate cost and fees as part of the selection process, the CMR selection point is best if sufficient design has been completed to permit reasonable numbers to be generated for the scope of preconstruction services and/or the magnitude of quantities of work to be priced in the proposal." (Gransberg & Shane, 2010, p. 2) This idea is also supported by CM/GC Guidelines for Public Owners by AGC's of America on page 30. This is same thought is also mentioned on page 100 of Evaluating the Preconstruction phase in a CM/GC project by Jeanna Schierholz. This is best practice is also supported and mentioned on page 3, 68, &70 by Minchin et al..	Arizona, Utah, Florida	This should be applied to being a major goal of the agency who is heading the project.	#9, #4, #16, #13	CMR	Validated BP	N/A
Technical	Procurement/Development	Owners develop a documented procedure for selection of CMR.	This procedure should be based on the project characteristics, there is a list of characteristics that work very well for CMR in the Synthesis 402 by Gransberg & Shane. The Synthesis also has a full report of UDOT's process that they employ in order to select the correct CMR and delivery method on pages 30-33.	UDOT	Refer to pages 30 to 33 in the report by Gransberg & Shane, 2010.	#9	CMR	Model Practice	N/A
Technical	Project Procurement/Development	Use of Best Value selection to select the CMR	Specifically for a two-step best value selection process: "the agency issues an RFQ and evaluates the qualifications of the respondents. It then develops a short list of the most qualified firms and invites the short listed competitors to submit a proposal in response to an RFP."(Gransberg & Shane, 2010, p. 38) CDOT, in particular, uses in their process to select a DB a, "Two-phase procurement method: The 'Two-Phase' selection procedure consists of a Request for Qualifications (RFQ) followed by a Request for Proposal (RFP). The Award criteria options include lowest price, adjusted low-bid (price per quality point), meets criteria and low bid, weighted criteria process, fixed price and best design, and best value."(Ashuri & Kashani, 2015, p.72)	CDOT	Gransberg & Shane go into further detail and explain all the intricate steps about this process in pages 38-41 of their report.	#9, #3	Both	Model Practice	YES
Institutional	Internal Affairs	During selection of the CMR, make the process as transparent as possible to avoid issues.	"Publishing as much information as practical about the content of the selection process and how the competing contractors will be evaluated enhances the transparency of procurement and avoids the appearance of favoritism. Publishing the role of the designer in the selection process as well as the required content of the interview, if there is one, reduces the probability of protest."(Gransberg & Shane, 2010, p. 50) Also mentioned by Minchin et al. on page 65 of report 787 he says that transparency is the most important aspect of a successful CMR project.	Memphis, Oregon, Utah, and Arizona	"First the owner must make sure that the grading criteria are known to the bidding contractors, then the owner must follow that grading criteria therefore making the process defensible. Unsuccessful bidders can then determine what factors in the process made them unsuccessful."(Schierholz, 2012, p. 21) Also, "The ADOT learned that it is a good idea to have a licensed contractor on the selection panel to ensure transparency and validate a fair and equitable evaluation." (Schierholz, 2012, p.115).	#9; #16;#13	CMR	Validated BP	N/A
Technical	Procurement/Development	Cost Modeling Should be Implemented	"A preconstruction cost model is a breakdown of the project's scope of work in dollar terms. Its purpose is to "validate the owner's budget" (Ladino et al. 2008) and to be able to price various alternatives during design in a manner that directly reflects how and when they will be built (Van Winkle 2007)."(Gransberg & Shane, 2010, p.55). It's basically used to validate an owner's budget and price alternatives during the design. It also evolves over the progression of the design and is used to support preconstruction cost estimates during milestones and review points.	Utah	"UTA also includes a clause in the design contract requiring joint development of the preconstruction cost model as an early task."(Gransberg & Shane, 2010, p.56)	#9	Both	Model Practice	No
Technical	Procurement/Development	Transparent Evaluation of Opening Bids	"An owner using a competitive design-build procurement process should ensure that the process is fair, open and transparent, using clear evaluation and selection processes"(Loulakis & Hoag, 2013, p.4).Also a suggestion mentioned on page 64 by Minchin et al. in report 787, "The selection committee should be blinded for the technical evaluation: "Proposer A," "Proposer B," etc."	Arizona	For ADOT, during their evaluation of the contractor SOQ's, they require each panel member who will evaluate the SOQ's to inform the agency if they have any conflict of interest with any of the contractors in question and if so they are removed from the evaluation panel. Also referring to this evaluation panel, all members evaluate the initial scores of contractors individually, they are eliminated if they do not provide comments about why they chose their scores and are eliminated if their score exceeds 1.65times the standard deviation of the recompiled scores(ADOT Intermodal Transportation Division, 2014, p 23).	#10, #1, #13	Both	Model Practice	Y/N: Does not include the model which Arizona Uses about elminiating reviews that are a certain distance from the standard deviation
Technical	Project Management	Ultimate subcontractors who perform the work of the project should be selected by the CM/GC	"Two of the states required that the contractors provide a subcontractor selection plan either in their proposals or during the design phase." "The agency also retains the right to audit and monitor the subcontracting process to protect the agency's interest" (Gransberg & Shane, 2012, p.48). However, the final selection ultimately should be by the CM because of a few reasons that are provided by Gransberg & Shane which include that "to get real-time pricing information, the CMR is able to communicate with the subcontractors it knows during preconstruction." & "Studies have shown that competitive pricing is "preserved" without competitive bidding. Therefore, requiring the CMR to award subcontractor work packages to an open field of competitors does not appear to save money." (Gransberg & Shane, 2012, p. 68).	Multiple	This is all backed up and explained on page 24 in CM/GC Guidelines for Public Owners.	#18; #9; #4	CMR	Model Practice	N/A
Institutional	Program Management	The agency should conduct debriefings when requested to DB shortlisted teams after the DB contract was executed in order to avoid protest.	SCDOT employs this policy in their own best practice guide. Although they don't name this as a reason, an advantage of this practice could also be that the agency is inherently helping to improve the overall quality of other DB firms so that in future projects, these firms can learn from their mistakes and provide a better response to an RFQ or RFP for a particular project. (AGC/ACEC/SCDOT Design-build Subcommittee, 2012, p.4)	South Carolina	This policy can be inserted into the overall guide that the agency employ's in their procurement process.	#2	DB	Model Practice	Yes

Technical	Procurement/Development	The RFP in a DB project should require a 30 to 90 day plans preparation period	"It is recommended that the RFP require a 30 to 90 day plans preparation period and the required review period be front-loaded into the project schedule prior to allowing the contractor to begin actual construction. This will allow the design process to get out ahead of the contractor as well as providing sufficient time for the Department to conduct its conformity reviews. This plans preparation time must be clearly spelled out in the RFP so that the DB Entities can include it in their contract time calculation."(MassDOT, 2006, p.15)	Massachusetts	This should be clearly inserted as a requirement into the RFP in order for both the designer and contractor are well aware of its presence.	#11	DB	Model Practice	Y/N: Does not specify the specific date that is given to each contractor
Technical	Procurement/Development	Have the CMR handle the entire ROW procurement process.	"Osceola County (see Case Study) lists in its Lessons Learned that they should have allowed the CM to handle the entire ROW procurement process, and would do so in the future."(Minchin et al., 2014, p. 59)	Florida	Assign this task to directly to the Contractor's contract.	#13	CMR	Recommended/Suggested practice	N/A
Technical	Design	Correlate directly the design packages with the subcontractor bid packages	This needs to especially happen in order to mitigate risk and fast-track the overall project. It can also greatly improve singings during the preconstruction process. "This permits the CMR to bid out those packages as soon as each package's design is ready. This also allows the construction to begin before the entire design is finished without burdening the budget with unnecessary contingencies for possible design scope creep."(Shane & Gransberg, 2010, p.15) "This makes the biddability review more efficient and reduces the risk to the subcontractors because they are given the specific design product they need for their bids; not just told to find their work inside the full set of construction documents." (Gransberg & Shane, 2010, p. 60)	Utah, Pinal County; Oregon, Texas	Construction of a clause within both the designer's and contractor's contracts that require them to collaborate on this matter in order for the procedure to occur.	#17; #9	CMR	Model Practice	N/A
Institutional	Program Management	Establish Clear Leadership for the designing and construction scheduling responsibilities	"Assigning the CMR the duties of scheduling for both design and construction during the preconstruction phase creates a point where collaboration is enhanced. This service was rated as the second most valuable preconstruction service by both the case study agencies and contractors, and ability to fast track was cited by 10 of the 15 papers shown in Table 1"(Gransberg & Shane, 2010, p.63-64).	Multiple	Sometimes it's better to assign both the designing and construction scheduling responsibilities to the CMR because it eliminates the disadvantage of having no clear leadership during the design process and it makes sure to keep the CMR and designer working well together.(Gransberg & Shane, 2010, p.15)	#9	CMR	Validated BP	N/A
Technical	Procurement/Development	CMR should validate and review the Design	"Design validation's purpose is to have the constructor evaluate the design as it is originally intended and compare the scope of work with both the required budget and schedule to determine if the scope can be executed within those constraints"(Gransberg & Shane, 2010, p.55). "Design review, on the other hand, is done to identify errors, omissions, ambiguities, and with an eye to improving the constructability and economy of the design submittal"(Gransberg & Shane, 2010, p.55). Minchin et al. also states on page 153, "UDOT's best design practice for keeping construction within budget is that when the team designed and priced the job, the contractor was at the table. Therefore, if there had been something missing in the design plan, the contractor would have been as responsible as anybody else. The contractor was paid for a CM role, which made it responsible for reviewing the set of plans and giving its input."	Utah	Assign this task to directly to the Contractor's contract.	#9; #13	CMR	Model Practice	N/A
Technical	Design	CMR should perform constructability review	"Essentially, constructability in CMR projects is a review of the capability of the industry to determine if the required level of tools, methods, techniques, and technology are available to permit a competent and qualified construction contractor to build the project feature in question to the level of quality required by the contract"(Gransberg & Shane, 2010, p.56). ODOT states this review as one of their preconstruction services on page 51 of the same report. As stated in the case study of ODOT by E. Minchin et al., "CM/GC designs typically come in under budget, and factors that most significantly contribute to this include constructability reviews provided by the CM."(2014, p.74)	Multiple (ODOT, Florida, Phoenix & more)	Jeanna Schierholz further elaborates on what exactly this entails/ why it is important in her paper 'Evaluating the preconstruction phase in a CM/GC project' on page (2010, p.18). But in the end this task should be assigned directly to the Contractor's contract.	#9; #16; #13	CMR	Validated BP	N/A
Technical	Procurement/Development	BBOs should be conducted at the 30%, 60%, 90% and 100% plans stages	"BBOs should be conducted at the 30%, 60%, 90% and 100% plans stages. BBOs are used by UDOT, for example, to have a snapshot of the status of the project budget prior to official bidding. The structure package had multiple BBOs as UDOT neared its budget limit. Though the Blind Bid Openings (BBO) process greatly aided the team in tracking its budget, it was unsuccessful at reducing unit prices"(Minchin et al., 2014, p.65). BBOs are defined on page 84 of the same report as, "the CM (contractor) generates a "bid," at designated milestones throughout the life of the project, estimating the eventual cost of the project. These figures are compared with an engineer's estimate and an ICE. This process helps keep project costs within acceptable limits."	UDOT	This policy can be inserted into the overall guide that the agency employ's in their procurement process.	#13	CMR	Model Practice	N/A
Institutional	Internal Affairs	Minimize schedule driven design	As stated in the lessons learned of their case study on CMR in Report 787, "Schedule-driven design does not allow enough time for coordination between the true cost and the cost model, which means that the ICE has difficulty defending its numbers."(Minchin et al., 2014, p.65)		This should be applied to being a major goal of the agency who is heading the project.	#13	CMR	Recommended/Suggested practice	N/A
Technical	Design	Add fees to require the CM to coordinate throughout the design.	"Fees were inserted requiring the CM to coordinate (throughout the design) and attend all regular design meetings. This is essential in order to develop options for reducing overall design costs and making up for coordination costs and the CM's overall fees."(Minchin et al., 2014, p.70) This quote is from the Osceola county case study.	Florida, Memphis TN	Memphis DOT also added some modifications in their contracts to ensure this, "The agency modified the design contract for the next phase of the project to coordinate design milestones with budget review points. It added an explicit requirement to coordinate the design work with the CMR's construction work packages and mandated joint coordination with third parties. This gave the designer a chance to propose a fee that reflected the changed scope of design coordination that is present in a CMR contract."(Gransberg & Shane, 2010, p.87)	#13; #9	CMR	Model Practice	N/A
Technical	Procurement/Development	Preserve the Designer's willingness to participate in preconstruction	"The most significant lesson learned in this study is that the agency needs to provide the designer with an opportunity to price its work appropriately by modifying the design contract to reflect the change in effort that CMR project delivery entails (10)." (Shane & Gransberg, 2010, p. 56) "This is not to say that the study found that design costs increase with this form of project delivery method. Indeed, the finding is just the opposite (Utah case study; Uhlik and Eller 1999; Alder2007)."(Gransberg & Shane, 2010, p.51)	Memphis, Utah	In order for the designer to price their work more appropriately, the agency needs to be able to accept some prices that may seem initially too high. In the long run, even though an upfront cost may be higher than expected, the costs saved through the extra initial efforts of the designer with out weigh this initial price increase.	#17, #9	CMR	Model Practice	N/A
Technical	Project Communications	Collaboration of CMR and Designer	"The solution to ensure collaboration is to modify the design contract to facilitate CMR project delivery. Doing this makes preconstruction collaboration enforceable and gives the designer the opportunity to set appropriate prices for the activities that do not occur in a DBB design project." (Shane & Gransberg, 2010, p.57) An example of something specific that Memphis did to ensure this collaboration was to insert "A similar clause rates the outcome and resolution of construction problems, such as change orders and delays, that result from poor design quality control" (Shane & Gransberg, 2010,p.58). "An owner should implement a procurement plan that will enhance the collaborative and other benefits of design-build, with the procurement plan being in harmony with the reasons that the owner chose the design-build delivery system."(Loulakis & Hoag, 2013, p.4)	TN	"The agency (a Memphis organization) modified the design contract for the next phase of the project to put 10% of the design fee at risk for the final quality of the construction documents (5% for design quality and 5% for construction issues due to design quality problems) as well as codified design milestones, budget review points, a requirement to coordinate the design work with the construction work packages, and mandated joint coordination with third parties. This change created a different environment in which the consultant saw the CMR reviews as another layer of design quality control, and the cooperation required for successful completion of the CMR project occurred." (Shane & Gransberg, 2010, p.58)	#17;#10	CMR	Model Practice	N/A
Technical	Procurement/Development	Cost estimating by the CMR is essential	Cost engineering by the CMR is viewed as an integral Preconstruction Service. "ODOT uses the CMR to furnish cost–risk analysis preconstruction services (Lee 2008)" (Gransberg & Shane, 2010, p.57). This means they are advising the agency on which cost items have the greatest possibility of going over budget. "Pinal County, Arizona, asked its CMR to forecast material pricing and uses that information to establish contingencies to mitigate volatility and to rearrange the work sequence to lock down the cost of the critical materials as early as possible"(Gransberg & Shane, 2010, p.57).	Oregon, Arizona	Assign this task to directly to the Contractor's contract.	#9	CMR	Model Practice	N/A

Technical	Project Procurement/Development	Detail Specific preconstruction services that the agency wants from the CM	"Detailing the specific preconstruction services the agency wants to be provided in the preconstruction services contract in the solicitation document leads to responsive proposals. This is critical to getting a reasonable proposal if costs are included in the selection process" (Gransberg & Shane, 2010, p.88).	Multiple	This should be applied to being a major goal of the agency who is heading the project.	#9	CMR	Validated BP	N/A
Institutional	Internal Affairs	"Effective Resource Loading"	This best practice name was taken word for word from the Osceola County case study recommended best practices, "Due to the high overhead on CMGC projects, the program must be resource-loaded up front, determining how many staff to bring on, how many hours they need to work during the entire project, and when they need to cut back on their hours to ensure that budgets and staffing requirements are met. This needs to be understood clearly by all members of the team to avoid causing any friction in expectations."(Minchin et al., 2014, p.185)	Florida	This can be achieved by a modeling succesful resource loading of past processes that were involved in similar size projects.	#13	CMR	Validated BP	N/A
Institutional	Internal Affairs	Owner Needs to Stay Involved	"The owner participates and collaborates to a great extent with the other project team members to administer and coordinate the CM/GC process, identify and develop the project scope, manage the project budget, and evaluate and negotiate changes"(Gransberg & Shane, 2010, p.28). "The "owner must be able to make timely decisions," and "owner personnel assigned to the project should have the authority to make the needed decisions . . . [and] stay abreast of what is happening on the project" (Gambatese et al. 2002)"(Gransberg & Shane, 2010, p.28).	Phoenix Arizona	As stated in their case for Phoenix Arizona, "They (City personnel) are involved on a daily basis in the field."(Minchin et al., 2014, p.190)	#9, #13	CMR	Model Practice	N/A
Institutional	Stakeholder/ Public Engagement	Assign the responsibility of interacting with the Public to the CMR	"The lesson learned from both projects [a UDOT and ODOT project that involved blocking a road and building a new bridge across a fishing sanctuary] is that assigning the responsibility to interact with the public to the CMR makes it become "the face of the project" and allows it to build relationships with external parties that pay dividends during construction."(Gransberg & Shane, 2010, p.59)	Oregon, Utah	Assign this task to directly to the Contractor's contract.	#9	CMR	Model Practice	N/A
Institutional	Internal Affairs	Training Needed	"All members of the design-build team should be educated and trained in the design-build process, and should be particularly aware of the differences between design-build and projects delivered under other delivery systems."(Loulakis, M., & Hoag, 2013, pg. 6) Enstrom & Loulakis mention that the best agencies are implementing training within their institution on page 11 of their presentation. This is also validated and suggested respectively by Minchin et al. on page 25 and 64 of their report 787. "Training of Selection Panels is necessary especially with a new scoring method and new approach.(2014, p.64)"	VDOT	"All the agencies visited held project manager training. At VDOT, generic project management training with a formal training curriculum is provided in-house." (McMinimee et al., 2009, pg. 3-3). In order for this training to occur in house there may have to be DB champions hired who have extensively worked with the delivery method at another part in the country.	#10; #12, #6, #13	DB	Validated BP	No
Institutional	Internal Affairs	Establish Proper Internal Infrastructure	"The project team should establish processes to enable timely and effective communication, collaboration, and issue resolution"(Loulakis & Hoag, 2013, p.7). There should be executive plans made, leadership groups, integration of key stakeholders, variation of multiple methods/philosophies, and the owner should be completely engaged and kept up to date with the project's progress.	Washington	As stated by Minchin et al., "To foster successful project completion, minimize issues and disputes among project participants, and better manage risks, WSDOT relies on collaborative relationships among project participants. In particular, the contract requires the parties to participate in a team building workshop conducted by a third party facilitator; coordinate respective roles, responsibilities and expertise; and foster open communications, non-adversarial interactions, and fair and transparent decision making and idea sharing."(2014, p. 45)	#10;#13	DB	Model Practice	Y/N: Mentiones a partnering Workshop but other than that, not much else.
Technical	Project Management	Use of project management software/ tool.	All states use some type of software that can facilitate communication, accountability and planning. Each state has a version of their own but they are all based off the same principles. "UDOT uses a tool called ePM that was evaluated by the study's team as the tool that requires the least extra work for the PM." (McMinimee et al., 2009, pg.3-4)	Utah/ Multiple	Many of these tools can be acquired through outside consulting agencies or even through asking for assistance from other states.	#12	Both	Model Practice	No
Technical	Project Management	Use of GIS and Data Management Tools.	Florida's ETDM process was also identified as a best practice, it is: "Florida's Efficient Transportation Decision Making (ETDM) Process is a new way of accomplishing transportation planning and project development for major capacity improvement projects. The ETDM process enables agencies and the public to provide early input to the Florida Department of Transportation (FDOT) and Metropolitan Planning Organizations (MPOs) about potential effects of proposed transportation projects. The goal of ETDM is to make transportation decisions more quickly without sacrificing the quality of the human and natural environments."(McMinimee et al., 2009, pg.3-11)	Multiple	Many of these tools can be acquired through outside consulting agencies or even through asking for assistance from other states.	#12	Both	Model Practice	No
Institutional	Stakeholder/ Public Engagement	Place a heavy emphasis on Community Involvement.	"The Best Practices the scan team observed reflected that community involvement is not a singular moment, but a project-long effort. Each transportation agency visited during this scan elevated community involvement efforts to a level that made them a positive force in the project development process."(McMinimee et al., 2009, pg. 6-1). "The Missouri DOT has also allowed specific projects to adopt their own brand and leveraged this action to achieve greater connectivity with the public." Like they gave a unique name to an upcoming project that would inevitably effect the general public to some degree." (McMinimee et al., 2009, pg. 6-1)	Arizona, Missouri	In particular, ADOT even made their own social media channels that had information on ongoing projects and how the public would be affected by their actions. This idea is also backed up and further ellaborated on by Kamran Ghavamifar on page 133 of his report.	#12, #8	Both	Model Practice	Y/N: Includes a clause about community relations but leaves most of the work up to the DB firm, doesn't place much emphasis
Institutional	Internal Affairs	Putting best people on the job and teaming with the best	"Putting best people on the design-build projects. Teaming with those that have design-build experience and past relationships"(Ernstrom & Loulakis 2012, pg. 12); As stated by Minchin et al., "Proven and experienced leaders and innovators should be the first people considered for the team. In Osceola County, leadership was as highly valued as technical competency (see Osceola County Case Study)."(2014, p. 54) Also in the Utah case study of the same document they said they feel comfortable with reducing the overall size of their staff if they have the right people working on the project at that time. (Minchin et al. 2014, p. 72)	Florida, Utah	This should be applied to being a major goal of the agency who is heading the project.	#6, #13	Both	Validated BP	Y/N: Mentions choosing the best qualified DB firm but does not mention anything from SHA side about having the best available team.
Institutional	Program Management	Owners should provide absolute clarity on their goals for the project.	"Examples of the agency goals that could be compromised include aesthetic considerations, safety, and commuter satisfaction. If an owner is not absolutely clear on its goals prior to procurement, DB can yield unsatisfying results (Molenaar 2005b; TCRP 2009)." So when owners use DB they should be absolutely clear on their goals that they supply to the DB builder. (Ghavamifar, 2009, p.123). In particular, UDOT defined a list of clear goals that use apply to all their projects stated on page 147 of the report by Minchin et al.	UDOT	"The agency can work with CMR during the design phase, and when negotiating the GMP to develop project goals and objectives in alignment with agency goals and ensure that they are achieved by the project. Since this is typically a qualifications-based selection, the request for proposal can help assure that agency goals and objectives are clearly incorporated in CMR proposals."(Ghavamifar, 2009, p. 122)	#8; #13	Both	Model Practice	Yes
Institutional	Program Management	Agencies should develop a database to maintain documents from previous design build projects.	In particular, SCDOT created a department to specifically comb over and organize these type of files in order to ensure improvement in future projects. In their best practice memorandum they state, "The Innovative Projects Section will maintain all current documents pertaining to design-build projects in order to ensure the tracking and implementation of "lessons learned" from previous design build projects."(2012, p.2) Also as stated by in the lessons learned section of a case study of ADOT by Jeanna Schierholz, "(Agencies should) Conduct post-project review meeting with all prime partners and document changes to improve future projects."(2012, p.100)	South Carolina, Arizona	This type of database can be set up in a digital format for easy widespread access from the whole organization. As SCDOT did, there can be a whole department of the agency to specifically focus on this database and maintain it in purpose to keep it organized and to keep it publicize it to other departments of the agency.	#2, #16	DB	Model Practice	No

Institutional	Program Management	There should be co-location of the entire team of professions from the contractors, designers, and the state agency.	As stated in their review on the Arizona DOT, FDOT observed that "Co-location can Lessen Gap between Design and Construction"(2002, p.7) "ADOT has used co-habitation or co-housing of the D/B firm key staff and agency oversight team to improve communication within the D/B delivery system.(200, p.7)"Also as stated in report by Minchin et al., "The agency specifies two main strategies to obtain an effective relationship such as co-location and adoption of a formal partnering process that is organized, implemented, and managed by the Design-Builder."(2014, p. 40). Also stated in the report but related to CMR,"Good results come from co-housing the entire team of professionals starting at the inception of the project."(Minchin et al., 2014, p. 54) This is also a best practice advocated by Osceola Country Florida case study.	Arizona, Utah, Florida	Both the owners and design-builders should be co-located in order to ensure a greater sense of over watch of the project and better parallel connection between to the two to facilitate communication. (Loulakis & Hoag, 2013, p.7)	#7, #13, #10	Both	Validated BP	Y/N: Does not specifically state co-location anywhere in the manual, but I personally know from the DBB project that I am involved in that we are co-located with the SHA.
Institutional	Stakeholder/ Public Engagement	The contractor should be present when dealing with third parties.	When referring to Third-party agreements and CMR: "As an example, among the agencies interviewed in this research, one strongly emphasized the benefit of having a contractor on board while negotiating with third parties [Weber County Commuter Rail]. In general, the CMR's knowledge of construction processes and sequencing can help clarify various aspects of project impact on communities and institutions; this will hopefully facilitate achieving understanding and approvals."(Touran et al., 2009, p.30) Also recommended in the report by Minchin et al., "Establish, as early as possible, a partnering relationship with all other stakeholders and work very hard at keeping things friendly between the parties. Continued coordination with appropriate people and stakeholders is very important during the project."(2014, p. 64)	Utah	Assign this task to directly to the Contractor's contract.	#20, #13	CMR	Model Practice	N/A
Institutional	Internal Affairs	When taking the first steps to implementing DB, agencies must address their formal and informal cultures alike. It is also important to educate the DPs and contractors about this change in culture.	"To effect meaningful organizational change, agencies must address their formal and informal cultures alike. Without attention to aligning these two organizational realities, agencies are likely to see opposition to new processes."(Minchin et al., 2014, p.14) "When an agency is procedurally rooted in traditional means and methods, it is likely to face varying degrees of opposition to innovative delivery approaches. Instead, the agency's formal culture should be open to innovation, risk-taking, and improvement of the status quo."(Minchin et al., 2014, p.14) "Similarly, the agency's informal culture must support an innovative project delivery method for it to succeed fully. Informal culture consists of the way an agency actually gets work done, apart from procedures and policies."(Minchin et al., 2014, p. 14)	Florida	From report 787, "It is important to educate DPs and contractors that have never worked on CM/GC projects that the entire culture of CM/GC is different than DBB or D-B, and to teach them about the culture."(Minchin et al., 2014, p.66) Related to culture is that in the Osceola County case study, they suggested to only keep people would had an attitude that supported CMR, (Minchin et al., 2014, p.185)	#13	Both	Model Practice	No
Institutional	Program Management	In the initial phases create a unit specifically dedicated to focus on DB.	"For example, several of the Washington Department of Transportation (WSDOT) employees assigned to the SR 99 project had been involved in other critical D-B projects."(Minchin et al., 2014, p.15) "To accommodate such new procedures, UDOT created the Office of Innovative Contracting and Project Controls within its Project Development Division. This office fosters the implementation of innovative project delivery methods by developing guidelines and supporting agency staff during the procurement and contract execution phases."(Minchin et al., 2014, p.17)	Washington, Utah	This should be applied to being a major goal of the agency who is heading the project.	#13	DB	Model Practice	No
Institutional	Stakeholder/ Public Engagement	Early involvement of project stakeholders and the public should be ensured.	As mentioned on one of the side quotes: "Early involvement by stakeholders is key to maintaining critical communication both before and after bid; cultivating buy-in from non-contractual stakeholders— e.g., utility companies and members of the public—is also crucial to preventing delays."(Minchin et al., 2014, p.18) This is also mentioned again in the Osceola Country Florida case study on page 181	Utah, Florida	"For the I-15 Core project, UDOT signed a master utility agreement with all utility owners affected by the project. This effort began prior to contract award and was concluded after contract award. The Design-Builder was responsible for developing the supplemental utility agreements and for coordinating all design and construction activities with utility owners."(Minchin et al., 2014, p.18) This should also be applied to being a major goal of the agency who is heading the project.	#13	Both	Model Practice	YES
Institutional	Program Management	Align the power of the purse and ultimate decision maker with the CMR	For one of the lessons learned in the project planning phase of the report by Minchin et al. it states, "Whoever has the purse strings and whoever makes the final decisions have to be on board with CM/GC."(Minchin et al., 2014, p.65) This was also specifically mentioned in the Phoenix case study on page 189.	Phoenix Arizona	If the power of the purse does not specifically lie with the agency then the agency can facilitate meetings and functioned between both the purse and the contractor. If the purse happens to be the agency, then it should be noted that an enhanced form of collaboration between the agency and the contractor should be one of the agency's major's goals to achieve.	#13	CMR	Model Practice	N/A
Institutional	Program Management	Do not change delivery systems mid-project	Minchin et al. lists this as one of their lessons learned in the CM/GC section on page 65.	N/A	This should be applied to being a major goal of the agency who is heading the project.	#13	Both	Recommended/Suggested practice	No
Technical	Project Management	When a CM is chosen, allow the CM to act as a CM, not as a low-bid contractor	As stated in the lessons learned of their case study on CMR by Minchin et al., "If the CM approaches the owner with a complaint about changed conditions, delays in reviewing shop drawings, other common delays, etc., the owner should not treat this like it would if a prime contractor on a DBB project made the same advances. Most CM/GC contracts make it clear that unless an incident caused the CM or a subcontractor to do something that was outside the boundaries of the contract (a material change), the CM just has to handle the situation. That is part of their CM fee. Paying the CM for handling such items is a dangerous precedent and amounts to double-paying the contractor."(Minchin et al., 2014, p. 65). This was also mentioned on page 173 front the Osceola county case study.	Florida	This should be applied to being a major goal of the agency who is heading the project.	#13	CMR	Model Practice	N/A
Institutional	Program Management	"A Good Plan Violently Executed Now Is Better Than a Perfect Plan Executed Next Week"	This best practice was taken word for word from the Osceola County's best practice recommendations, "The entire team must make timely, difficult, and binding decisions within the scheduled time available. Hesitation will kill the project's momentum, schedule, and budget and will cause the team members to lose interest and move on to other urgent projects."(Minchin et al., 2014, p.185)	Florida	This should be a relative goal of the agency.	#13	CMR	Model Practice	N/A
Technical	Procurement/Development	Use of Progressive rather than lump sum GMP(Guaranteed Maximum Price)	"The use of progressive rather than lump sum GMPs appears to add value to the CMR project by reducing the total amount of contingency carried in the GMP and by allowing an orderly method to price early work packages and/or construction phases. It also provides a series of points where the agency can negotiate the allocation of cost and schedule risks with the CMR."(Gransberg & Shane, 2010, p. 2). This is also further discussed on page 74 of the same report. Having a progressive GMP also, "This reduces the risk to the constructor and the amount of contingency that the CMR maintains against the cost risks of material price escalation, subcontractor availability, and scope creep during design."(Gransberg & Shane, 2010, p.16)	Utah and other two most experienced states with CMR.	"Some agencies like UDOT use a progressive GMP to keep project contingencies as low as possible. They are essentially breaking down the project into phases and work packages and making the CMR generate indy GMPs for each one as they are completed. (Three most experienced case study agencies all use progressive GMPs.) "This leads to the conclusion that agencies planning to use CMR seriously consider incorporating a progressive GMP into their procurement package."(Gransberg & Shane, 2010, p.74)	#9	CMR	Validated BP	N/A
Technical	Procurement/Development	Open and split of Contingency (Contingency sharing to reflect the risk)	"Splitting the contingency between the owner and the CMR appears to make accounting for contingency allocation less onerous. An open books approach to contingency calculation and allocation enhances the spirit of trust between the owner and the CMR. (Gransberg & Shane, 2010, p.76)" "Though not common practice at this time, it is wise to set the contingency amount(s) based on the findings of a thorough risk analysis whenever possible."(Minchin et al., 2014, p. 61)	Department of Energy	As related to the open books approach, "One thing that builds trust among contract parties like few other things is the concept of "open books." This involves sharing project information among parties to the contract that, in other settings, might be considered proprietary and carefully guarded."(Minchin et al., 2014, p. 61)	#9, #13	CMR	Recommended/Suggested practice	N/A

Technical	Procurement/Development	Use Unit prices when establishing a GMP	"Simplify the process of establishing a reasonable and realistic GMP as much as necessary by putting many of its components into unit prices."(Gransberg & Shane, 2010, p.88) This is also stated as a best practice by the City of Phoenix in the their case study in Minchin et al.'s 2014 report on page 190. Also the same study, it states in the lessons learned section by various DOT's from CMR, "The easiest way to pay the contractor and please FHWA auditors is to use either straight Unit Price, or a combination of Unit Price and Lump Sum or Unit Price and Cost-reimbursable."(2014, p. 64)	Phoenix Arizona, UDOT	As stated from the UDOT case study done by Gransberg & Shane regarding establishing a GMP, "Simplify the process of establishing a reasonable and realistic GMP as much as necessary by putting many of its components into unit prices."(88)	#9, #13	CMR	Model Practice	N/A
Institutional	Internal Affairs	Employment of an Independent Cost Estimate(ICE)	Utah DOT uses this for cost validation and it reflects the current market conditions.(Park, 2014,p. 4) "...the most noted use of the ICE consultant is to conform risks and to negotiate risk pricing and assumptions...the DOT uses the other two estimates[one made by the ICE] in the CMGC process to open up discussions with the CMGC contractor about Guaranteed Maximum Price (GMP), and any differences there might be in the prices."(Schierholz, 2012, p. 64)	Utah	"The ICE consultant usually can stay on the project after the GMP and help in validating the CMR's estimates and adjustment of the scope of the project if the agency can afford him." "The ICE consultant truly acts as a valuable fourth member of the CMGC team. The ICE consultant brings construction experience and knowledge to the table, and can offer valuable suggestions for the team while remaining objective in their opinions."(Schierholz, 2012,p. 63)	#15, #16	CMR	Model practice	N/A
Technical	Procurement/Development	During the GMP process the CMR should open its books and share with the owner its subcontractor bids	"GMP is supposed to address the remaining unfinished aspects of the design, this can in fact increase disputes over assumptions of what remaining design features could have been anticipated at the time of the negotiated bid. One mitigating approach to this problem is for the CMR to open its books and share with the owner its subcontractor bids, ensuring transparency in the process."(CMAA, 2012, p.23) In the mountain view corridor Utah case study in the report by Minchin et al., they stated that one of the main reasons they used CMR was because of "Open Book Pricing" (2014, p.147).	Utah	Assign this task to directly to the Contractor's contract.	#19, #13	CMR	Model Practice	N/A
Technical	Procurement/Development	Agree first on quantities when dealing with cost estimating and comparison.	"In their cost estimating and comparison process with the contractor, UTA would agree first on quantities. By dealing with this issue early and directly, a potential area of disagreement was taken off the table. UTA also used a software product called HCSS, which enabled it to reach agreement very quickly on all but 10–20 bid items. UTA then was able to focus on those 10–20 items and resolve them in short order. This is a much more efficient process than other agencies have used for CMGC cost estimating. After reaching an agreement on the line items, UTA would negotiate the soft costs."(Minchin et al., 2014, p. 215)	Utah	This should be a relative goal of the agency.	#13	CMR	Model Practice	N/A
Institutional	Program Management	CM to buy into the design	"One of the case study project contractors described the idea of having "buy-in" to the design, making the CMR less prone to submit a claim for additional compensation for design problems in features of work for which the CMR had been paid to review and furnish input."(Gransberg & Shane, 2010, p.79)	Multiple	Assign this task to directly to the Contractor's contract.	#9	CMR	Recommended/Suggested practice	N/A
Technical	Risk Management	When selecting the CMR, should emphasis past experiences and qualifications.	"Based on the conclusion that CMR qualifications and past experience have the greatest perceived impact on project quality, the CMR selection process evaluation plan could consider giving the greatest weight in the award algorithm to qualifications of the CMR's personnel and its past project experience ("CM/GC Peer Review Meeting" 2003; DeWitt et al. 2005; Qaasim 2005).(Gransberg & Shane, 2010, p.81) "There was unanimous agreement by both the owners and their contractors that the aspects that have the greatest impact on project quality are the qualifications of the CMR's personnel and its past project experience. ODOT interviewee stated that "qualifications are critical to achieving quality."(Gransberg & Shane, 2010, p.77) In Minchin et al.'s report on page 55, the city of Phoenix says quality of contractors supersedes everything.	ODOT, Phoenix Arizona	This should be applied to being a major goal of the agency who is heading the project.	#9, #13	CMR	Model Practice	N/A
Technical	Risk Management	Utilization of a tool like CEVP	Washington's DOT has utilized this tool since 2002 that addresses risks and assists in managing factors that could negatively impact project capital costs. "CEVP represents a process whereby the PM, team members, and invited specialized experts review the project and the risk elements associated with delivering the work. From this process emerges a series of quantifiable impacts the agency can then use to assess mitigating strategies, ensuring an optimal approach to risk management."(McMinimee et al., 2009, p. 3-7)	Washington	Many of these tools can be acquired through outside consulting agencies or even through asking for assistance from other states.	#12	Both	Model Practice	No
Technical	Risk Management	Employ quality checkpoints and incentive specifications	"ADOT uses quality checkpoints in construction and quality incentive specifications for workmanship to improve quality."(FDOT & FHA, 2002, p. 6) Also this study pointed out that it was a very effective strategy to "Broaden Incentive Program to include Contractor Field Supervisors."(FDOT & FHA, 2002, p. 7)	Arizona	This should be applied to being a major goal of the agency who is heading the project.	#7	Both	Model Practice	No
Technical	Risk Management	Develop a quality management plan	Specifically for UDOT they were observed in the report by Minchin et al. doing, "To ensure design package quality and compliance with contractual document requirements, the agency requires the Design-Builder development of a comprehensive quality program to be detailed in a Quality Management Plan (QMP)."(2014, p. 40) "The Quality Management Plan (QMP) is the document detailing all quality program procedures adopted by design-builders."(Minchin et al., 2014, p.121)	Utah	The most effective quality management plans will be in some form based of existing standards within the agency that reflect the agency's goals but it could be worthwhile to review other state DOTs to see their exact plans. This plan could be first created by a committee and then reviewed by a greater board of directors for either a specific project or for the agency as a whole.	#13	DB	Model Practice	Yes
Technical	Risk Management	Use same QA program as DBB	"Eight of ten case study agencies use the same quality assurance (QA) program for CMR as they do for DBB. Therefore, it appears that no modification is necessary to a DOT's QA program to implement CMR project delivery. (Gransberg & Shane, 2010, p.88)" Also information on page (Gransberg & Shane, 2010, p.81) of the same report.	Multiple		#9	CMR	Validated BP	N/A
Technical	Construction Procedures	Potentially consider taking on more risk than previously planned for.	"When UDOT took on an inordinate and unbalanced share of the risk on the MVC project, it not only brought the contractor's prices down by millions of dollars as a natural reaction to suddenly not having to add contingency to the contract price, but it also freed the contractor to implement several innovative construction methods which eliminated some work and lowered the cost to perform other work, saving additional millions of dollars (see MVC Case Study)."(Minchin et al., 2014, p. 81) WSDOT also mentioned that they employed a plan like this on page 136.	Utah, Washington	The added risk can come from a wide range of areas but it should not be so significant where it would be impossible to recovery from if it were to actually occur.	#13	CMR	Model Practice	N/A
Technical	Construction Procedures	Use monthly reports along with invoices to ensure construction cost control	"Among Osceola County's best practices to ensure that the construction cost was kept within budget were monthly reports turned in along with the invoices for the CM. These gave detailed information on all costs to date and were compared to the schedule of values that had been approved for the project. Also, actual costs were provided during each step of the preliminary designs, which eliminated the traditional procedure of waiting for bids to come in once the entire project is designed to completion or preparing a final engineer's estimate, as in DBB."(Minchin et al., 2014, p. 178)	Florida	Assign this task to directly to the Contractor's contract.	#13	CMR	Model Practice	N/A
Technical	Construction Procedures	Employ multiple means of cost control for the construction process.	"Best design practices for controlling construction costs include requiring contractors to submit their prices at predetermined milestones, requiring that all work be done using the unit price contracting method, using actual subcontractor quotes to generate the GMP, when possible, bringing the contractor and DP onboard at the same time and negotiating contracts at the same time, and finally, once the contractor is brought in, having them join in the validation and negotiate the GMP." (Minchin et al., 2014, p. 69) This quotes are taken from the case study No. 2 which is about the city of Phoenix Arizona.	Arizona	Additionally an ICE could be brought on board not only to review the proposed price for the design but to also review prices that occur during the later construction phases.	#13	CMR	Model Practice	N/A

Institutional	Program Management	Two-step process for ATC implementation	Agencies conduct regular one-on-one with bidders about ATC issues. NC has preliminary and formal approval processes: in preliminary process, bidders bring out ATC concepts so to gauge their potential and avoid wasting time if the ATCs have no change of being approved; the formal process are reviewed by NC DB Group and other relevant offices. NC: Rejected ATCs are used as RFP revisions so to tell other bidders the ideas are not approved. CO: Innovative Contracting Branch is responsible for communicating with bidders on ATCs; they either approve or rejects each ATC or refer it to specialty units.	Colorado, North Carolina	Preliminary and final processes. In preliminary process, contractor provides a short (1- to 2- page) description of the concept. The agency will either reject the ATC outright or tell the bidder to proceed to a formal approval process. The formal ATC approval process involves a fully developed concept that gets reviewed by the Design Build Group and other relevant offices.	#5 (p.13)	DB	VBP	Yes
Institutional	Program Management	A reflective way for interested bidders to weigh their potential of winning and decide if they want to participate in bidding	FDOT receives the LOIs, grade them and let the firms know their firms grades. The firms decide if they still want to continue participating in the procurement process.	Florida	Grade LOIs and give back the grades to firms	#5(p.15)	DB	MP	No
Institutional	Program Management	Express DB program: Small bridge projects consolidated to fewer contracts aimed for fast delivery. It allows small firms to participate because of minimal pre-award design effort.	NCDOT bundles roughly 400 small bridge projects that into 39 contracts. The state provides estimated spans and other specifications for these bridges for bidders to base their bids on. If the final specifications are different from those estimates, the payment is adjusted accordingly. Intended for projects with little or no room for innovation. Benefit: Opportunity for smaller / risk averse consultants / contractors to participate; minimal pre-award design effort; agency stipend offset pursuit cost; staggered bids offered design schedule flexibility; agency is able to plan crew backlog and allocate resources efficiently.	North Carolina	One SOQ per team • Contractor listed preference of Contracts for which they want to be shortlisted, in priority order • Shortlisting for all contracts per year occurred concurrently • Once shortlisted teams were announced, the RFPs for the individual contracts were released, staggered over the course of four months • Question and Answer sessions were held on each RFP • Price Proposals were submitted and the awards were made to the lowest bidder • Prime contractors shortlisted on no more than five contracts per year	#5(p.17)	DB	MP	No
Institutional	Stakeholder/ Public Engagement	Soliciting stakeholders' and industry partners' input during development of DB program	They may contribute in the following activities: Drafting enabling legislation, DB education workshops, periodic stakeholder meetings to review the DB program, commenting on draft documents. Industry partners include American Consulting Engineer's Council (ACEC), ASCE, International Federation of Professional and Technical Engineers (IFPTE), and the Associated General Contractors of America (AGC).	Washington State		#14 (p.27/189)	DB	RP	YES
Institutional	Program Management	Having a DB champion and a DB policy committee within the agency	The person will serve as the single point of information for the DB program and an advocate for the delivery method. The committee will discuss DB relevant issues that affect departmental policies and procedures.	Example states to be listed.	Title used include design-build program director, design-build program manager, design-build contracting engineer, and design-build specialist. He or she should facilitate procedural changes within the agency as well as cultural changes. The committee should be scheduled to meet on a periodic basis to discuss global issues, and should be available to meet as important project issues arise that shape agency policy. Representation in the group will vary by agency, but design, construction, procurement, and legal stakeholders should have strong representation. Additionally, some agencies have chosen to include design consultant and contractor representatives on the committee.	#14 (p.28/189)	DB	RP	No
Institutional	Internal Affairs	Writing white papers on important policy issues; develop guidelines and manuals	The white papers should be written by the stakeholders who are most affected by the issue. Minnesota DOT cover the following topics in their white papers: Third Party Agreements, Approach to Alternative Technical Concepts, Approach to Notice to Proceed, Approach to Change Order, Approach to Differing Site Conditions, Approach to Dispute Resolution. Guidelines and manuals stimulate discussion of important issues and can help to create consistency in methods across the agency.	Minnesota DOT: white papers; Arizona, Colorado, Florida, Montana, Washington State: guidelines or manuals	Guidelines and manuals can vary in length from 20 to 200 pages depending upon their purpose. They are typically intended to serve as a single source for design-build procedures and policies. They must be living documents as the design-build program develops and they need to have resources committed to keeping them current.	#14 (p.28/189)	DB	RP	Y/N: No mention of white papers but the DB manual does exist.
Institutional	Program Management	Pilot projects and benchmarking of performance	Numerous agencies have treated their first design-build projects as "pilots" to test the delivery method. The benefit in doing this is that there is a clear understanding that the process is new and will evolve.	Arizona, Colorado, Florida, Indiana, New Jersey, Minnesota, Ohio, Oregon, Washington State	It requires that the project performance is reviewed and the results are disseminated in the form of lessons learned.	#14(p.29/189)	DB	Model Practice	No
Institutional	Internal Affairs	Establishing project goals early in the project procurement process	It creates alignment between internal agency personnel, design-builders, and project stakeholders and helps define the agencies' requirements in terms of schedule, cost, quality, aesthetics, and end user requirements.	N/A	1. Justify the selection of design-build delivery for the project on the basis of the delivery method's benefits. 2. From this justification, establish project goals for schedule, cost, quality, and innovation. 3. Rank these goals in order of importance. 4. Publish the goals in the RFQ and RFP. 5. Using best-value procurement, develop evaluation criteria that reward proposers for meeting or exceeding the project goals. 6. Remain consistent with the goals after award throughout project design and construction.	#14(p.35/189)	Both	MP	Yes